

111. AQUATIC COLLECTING APPARATUS

These are a wide variety of items used in collecting plant and animal specimens from the aquatic environment. Remember to use waterproof and water resistant materials wherever possible in the construction of this apparatus.

A. NETS AND DREDGES

Nets and dredges are easily made items useful in collecting both plants and animals. They are all made with some sort of netting or mesh.

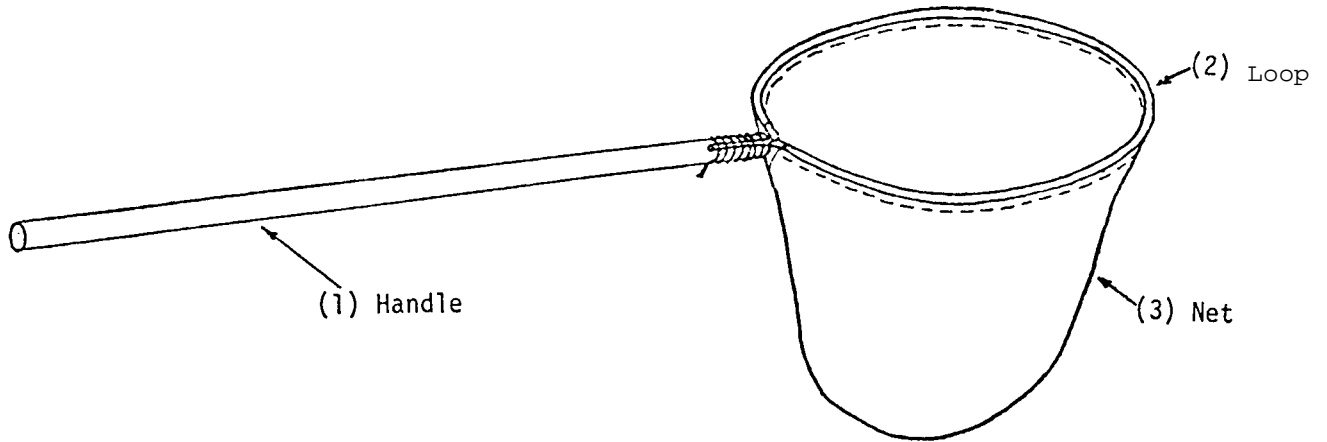
B. AQUATIC TRAPS

These two traps can be used to catch some types of aquatic animals.

C. SUPPLEMENTARY AQUATIC MATERIALS

Materials included here are less necessary, yet still useful, items in aquatic collection.

Al. Dip Net

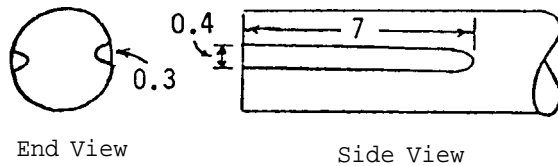


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Handle	1	Wood Dowel (A)	100 cm long, 2 cm diameter
(2) Loop	1	Heavy Wire (B)	115 cm long, 0.3 cm diameter
	1	Stiff Wire (C)	About 80-90 cm long, 0.1 cm diameter
(3) Net	1	Nylon Bag (D)	50 cm wide, 60 cm long

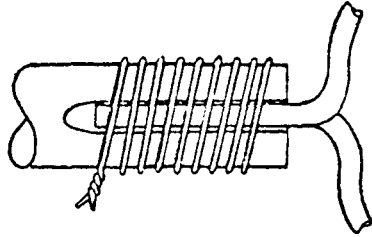
b. Construction

(1) Handle



The length of the handle may be varied according to personal preference. cut two grooves in one end of the wood dowel (A), one opposite the other. Make these grooves about 7 cm long, 0.3 cm deep, and about 0.4 cm wide.

(2) Loop



Binding of Loop
to Handle

Form a loop 30 cm in diameter from the heavy wire (B). Leave about 7 cm of excess wire at each end which will fit into the grooves in the handle. Bend these 7 cm portions to 90° angles. Fit the wire ends into the grooves in the handle and bind them in place with the stiff wire (C).

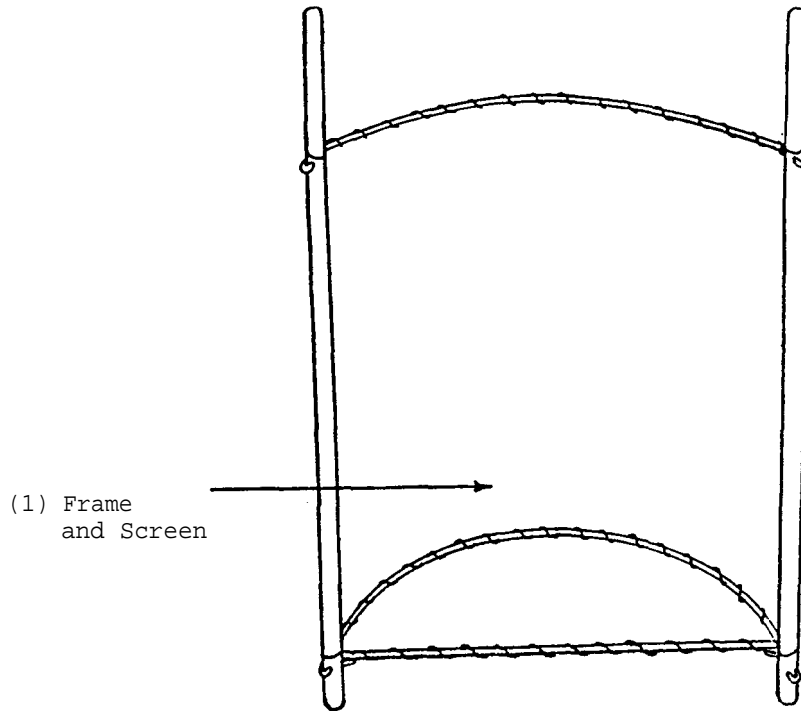
(3) Net

If a nylon laundry bag (D) of the given dimensions is used, cut it down so that it is only about 30 cm deep rather than 60. Other types of cloth or netting can also be used. Use cloth or netting through which water can easily pass, but remember that the size of the net weave determines the size of the smallest organisms which will be held by the net. Make sure the opening of the net is 5 - 10 cm greater in circumference than that of the loop. Simply sew the open portion of the net around the loop with strong thread.

c. Notes

(i) The dip net is used to collect aquatic organisms of all kinds from the shore or boat. Be sure to make its construction as sturdy as possible.

A2. Hand Screen



a. Materials Required

Components

(1) **Frame and Screen**

Qu Items Required

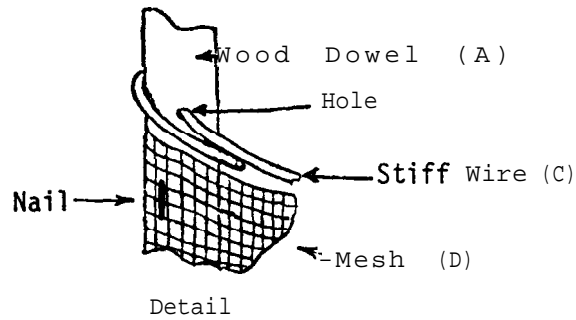
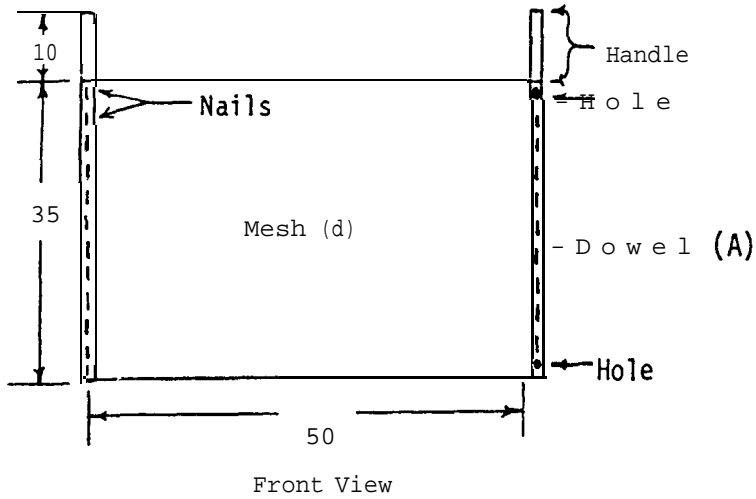
- 2 Wood Dowels (A)
- 1 Stiff Wire (B)
- 2 Stiff Wire (C)
- 1 Fine Wire Mesh (D)
- 1 Fine Wire Mesh (E)
- 1 Fine Wire (F)

Dimensions

- 45 cm long,
1.5 cm diameter
- 35 cm long,
0.4 cm diameter
- 50 cm long,
0.4 cm diameter
- 35 cm x 50 cm
- 30 cm x 15 cm
- 150 cm long,
0.05 cm diameter

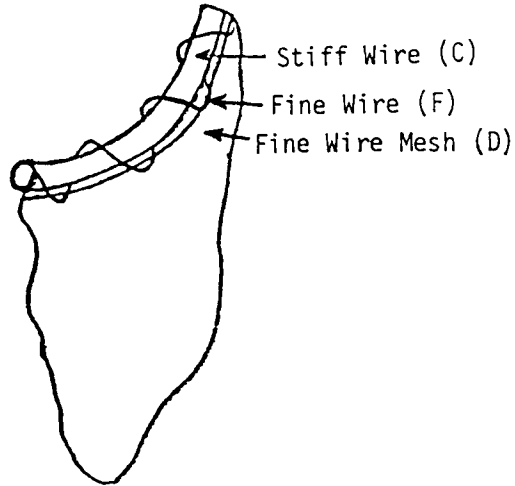
b. Construction

(1) Frame and Screen



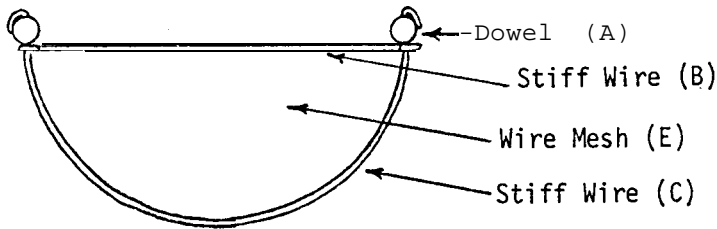
Set the two wood dowels (A) so that they are 50 cm apart. Take the wire mesh (D) and secure it to the dowels by wrapping it around each dowel once and then nailing it in place on the dowel. Be sure to leave 10 cm free at one end of each dowel to serve as handles. Drill two holes, 0.4 cm in diameter, in each dowel; drill the first 1 cm from the end with which the wire mesh is even, and the second, 12 cm from the end which is to be the handle.

Bend the two 50 cm sections of stiff wire (C) into semi-circles, each with a diameter of 30 cm. Place one end of one piece of wire into one hole of the wood dowel, so that about 5 cm of wire is protruding out of each hole. Bend these end pieces around the wood dowel until they reach the main body of wire. Follow this procedure for the other piece of wire. These two pieces of wire now form an outside frame to which the wire mesh (D) is attached.



Detail

Using the fine wire (F), in much the same way as one would use thread in sewing, wire the wire mesh (D) to the stiff wire frame, letting the edges of the wire mesh slightly overlap the wire frame.



Bottom View

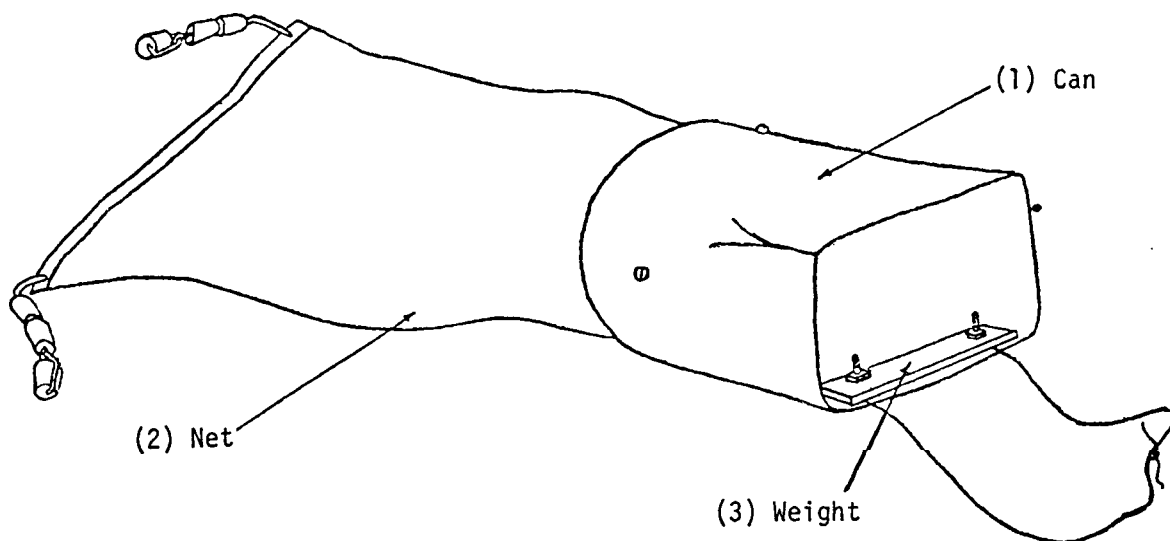
Take the last piece of stiff wire (B) and run it between the ends of the two wood dowels with which the wire mesh is flush. Secure it by bending about 3 cm of each end around the wire frame. Now, take the remaining piece of wire mesh (E) and cut it into the shape of a semi-circle. Wire this semicircle onto the bottom of the hand screen with the "sewing" method described above.

c. Notes

(i) This simple device is an effective means of collecting small plants and animals in streams. To operate, simply hold it in the water and permit the stream water to flow through the wire mesh and remove organisms as they are collected.

(ii) As an extra measure, have someone stand upstream and disturb rocks, thus chasing out underlying organisms.

A3. Dredge

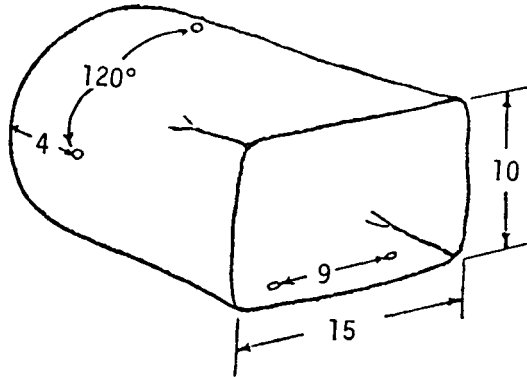


a. Materials Required

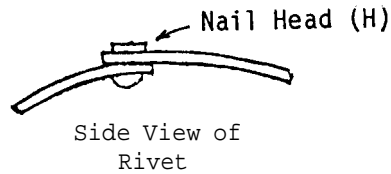
<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Can	1	Tin Can (A)	15 cm diameter, 18 cm long
(2) Net	1	Nylon Bag (B)	50 cm wide, 60 cm long
	1	Wire Strapping (C)	50 cm long, 1.5 cm wide, 0.05 cm thick
	3	Bolts (D)	1.5 cm long
	3	Nuts (E)	To fit bolts
	2	Cords (F)	20 cm long
	6	Corks (G)	3 cm x 3 cm
	1	Nail (H)	0.5 cm long
(3) Weight	2	Steel Bars (I)	12 cm x 3 cm x 0.3 cm
	2	Bolts (J)	1.5 cm long
	2	Nuts (K)	To fit bolts
	1	Cord (L)	100 cm long

b. Construction

(1) Can

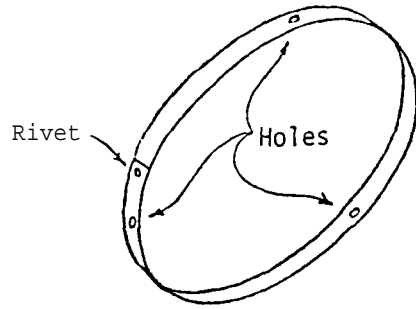


(2) Net



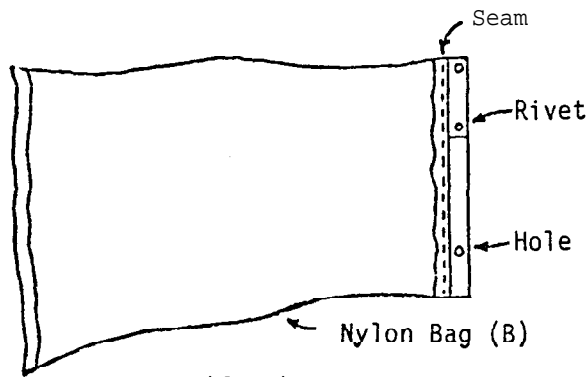
Cut both ends from the tin can (A). Flatten one end of the can to a rough rectangular shape about 15 cm x 10 cm. Drill three holes in the round end of the can, each about 4 cm from the ends. Space these holes every 120° and make them slightly larger in diameter than the bolts (D) used. Make two more holes the same diameter at the other end of the can. These holes should be about 2 cm from the edge and 9 cm apart.

Make a loop from the strapping (C) that will fit inside the can (i.e., slightly smaller than 15 cm in diameter). To do this easily, drill a small hole near each end of the strapping. Cut the head off a flat-headed nail (H) and insert this nail through the holes in the strapping. Flatten the nail down like a rivet to hold the loop together.



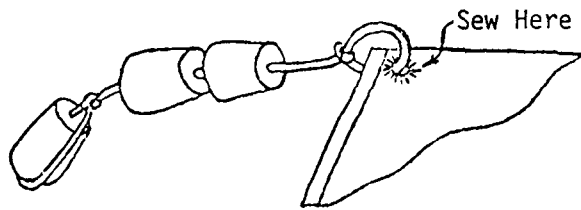
Strapping Loop (C)

Drill holes in the strapping which will align with the holes in the round end of the can. One might wish to drill these holes before riveting the loop together. These holes should be the same diameter as the holes in the can.



Side View

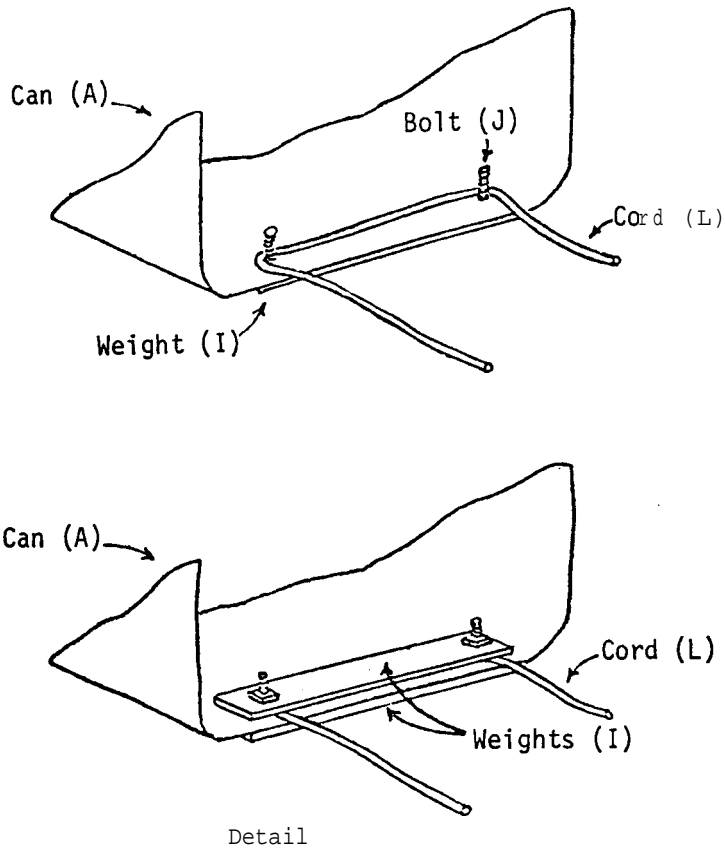
Sew the open end of the nylon bag (B) around the strapping loop with stout thread. The net may also be made from nylon netting if ready-made bags are unavailable. Punch holes through the nylon bag to correspond to the holes in the strapping loop. Fasten the net and loop to the can with the three nuts (E) and bolts (D).



Detail of Cork (G) Attachment

Punch holes through the six corks (G) and tie one of them to each of the two cords (F). Run each of the cords through two of the remaining corks and tie one cord to each corner of the net (B). It may be necessary to sew around each connection to prevent the nylon from tearing.

(3) Weight



Drill two holes slightly larger than the bolts (J) used in each steel bar (I). Make these holes 9 cm apart so they will align with the holes already drilled in the can. Insert the two bolts (J) through the holes in one of the steel bars and then put the bolts through the holes in the can so that the steel bar weight is on the outside of the can. Stretch the cord (L) around the two bolts.

Place the second steel bar (I) over the two bolts and fasten with the nuts (K). The cord (L) should be firmly held between the can and bar. Tie the loose end of the cord together to form a loop.

c. Notes

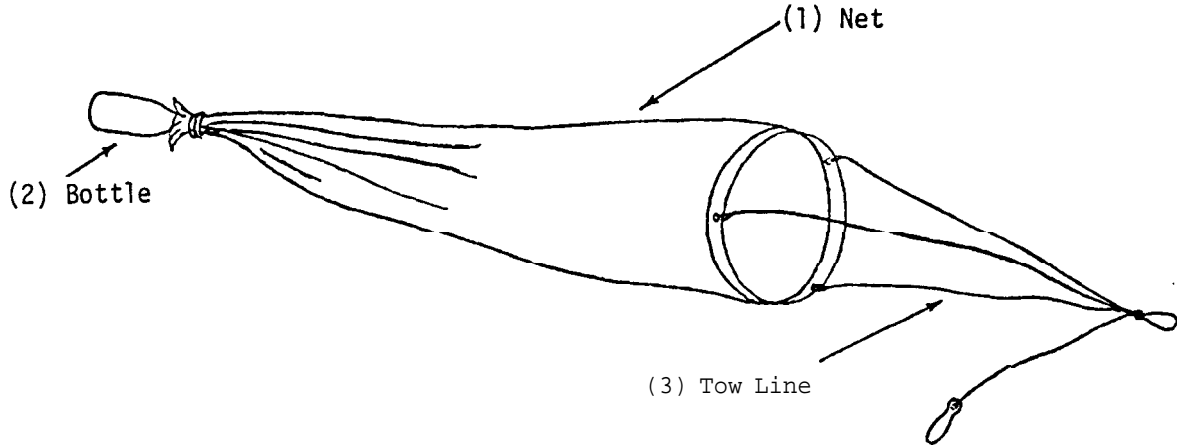
(i) In use, the dredge is tied to a long rope and dragged along the bottom of a body of water. Organisms living on or near the bottom are collected in the net.

(ii) The weights insure that the dredge will stay in the correct position on the bottom. The corks are to help keep the net off the bottom until it is

filled with collected material. This prevents it from being torn.

(iii) Use water resistant materials wherever possible in construction of this and all aquatic apparatus.

A4. Plankton Net *

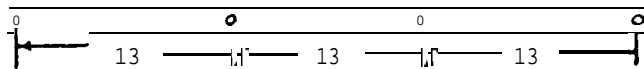


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Net	1	Nylon or Silk Stocking (A)	About 50 cm long
	1	Metal Strapping (B)	40 cm long, 1.5 cm wide, 0.05 cm thick, 2.5 cm diameter
(2) Bottle	1	Glass Bottle (C)	2.5 cm diameter, 6 cm long
	1	Rubber Band (D)	--
(3) Tow Line	2	Cords (E)	60 cm long
	1	Lead Weight (F)	Weight is variable

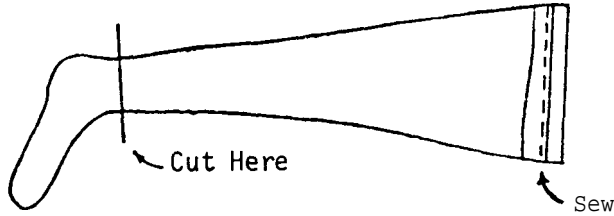
b. Construction

(1) Net



Drill four holes into the metal strapping (A) at 13 cm intervals. Make the holes about 0.3 cm in diameter.

*Adapted from Biological Sciences Curriculum Study, High School Biology: Student's Manual, (Chicago: Rand McNally and Company, 1963), p 157.

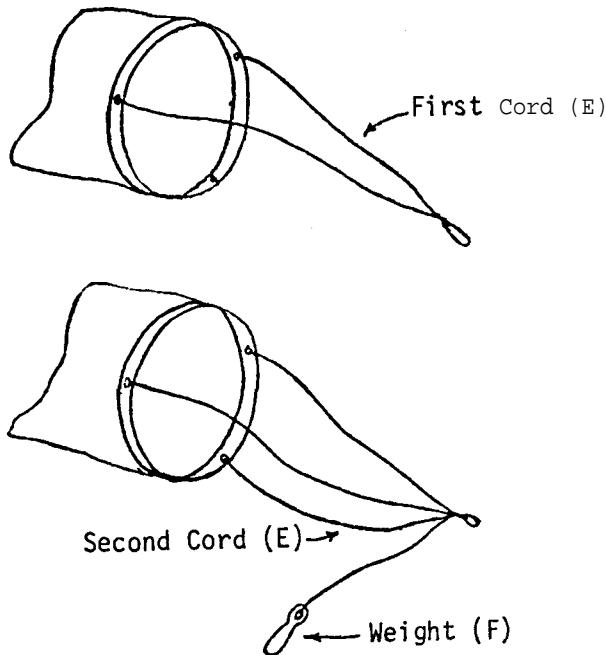


Hold the strapping in a ring shape and sew the open end of the stocking (A) to this ring. Cut off the foot of the stocking.

(2) Bottle

Attach the glass bottle (C) to the end of the net by wrapping the rubber band (D) tightly around it. Be sure the opening to the bottle is not clogged by material from the net.

(3) Tow Line



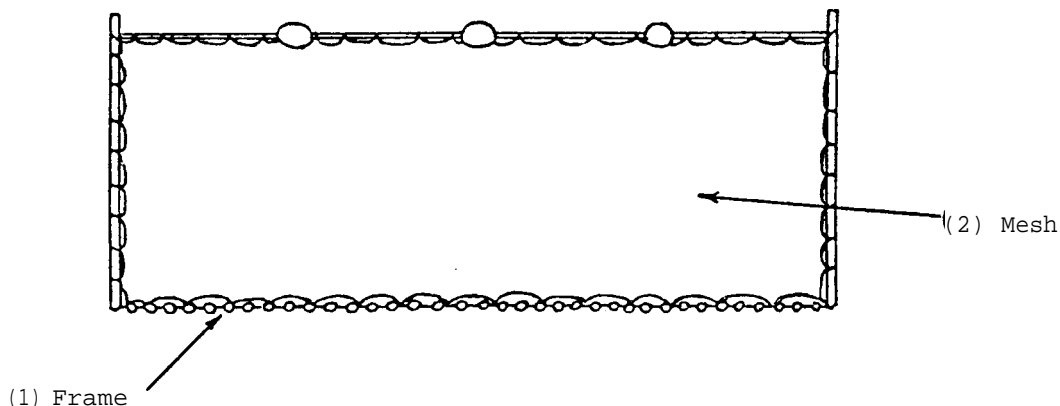
Punch small holes in the net to correspond to the three holes in the strapping ring. Tie one end of one cord (E) to one of these holes, make a loop in the middle of the cord, and tie the other end to the hole formed where the two ends of the strapping overlap. Next, tie the other cord (E) to the remaining hole in the ring. Tie the middle of this cord to the knot in the other cord, and tie the free end to a lead fishing weight (F).

c. Notes

(i) The plankton net is best used by dragging it behind a boat near the surface of the water. Organisms are trapped in the bottle as the water washes through the net.

(ii) Use netting with as fine a mesh as possible. An old parachute is an excellent source of material for the net.

A5. Two-Man Seine*

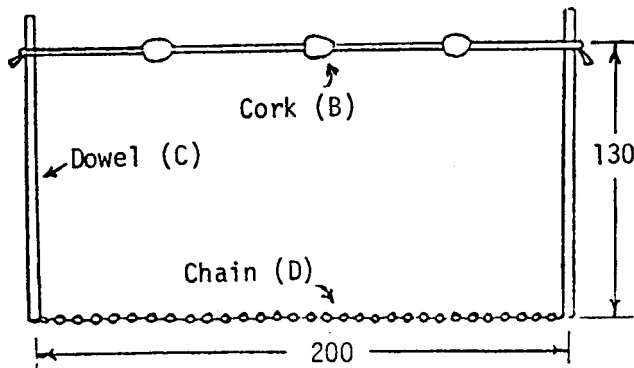


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Frame	1	Nylon Rope (A)	250 cm long, 0.5 cm diameter
	3	Cork Floats (B)	15 cm long, 10 cm diameter
	2	Wood Dowels (C)	150 cm long, 3 cm diameter
	1	Galvanized Chain (D)	200 cm long
(2) Mesh	1	Nylon Cord (E)	About 1000 cm long, 0.2 cm diameter
	1	Nylon Seine Net (F)	130 cm x 200 cm

b. Construction

(1) Frame

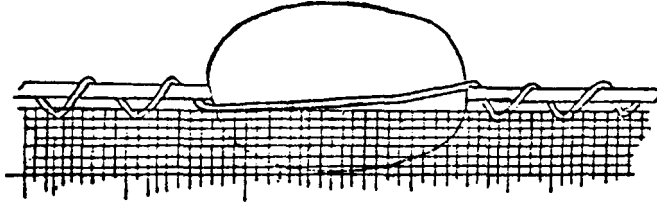


Fasten the ends of the chain (D) to the bottoms of the wooden dowels (C). Tie one end of the nylon rope (A) to the top of one dowel about 20 cm from the end. Run the free end of the rope through the holes in the cork floats (B) and tie it to the other

*Adapted from Jens W. Knudsen, Biological Techniques, (New York: Harper and Row, 1966), p 326.

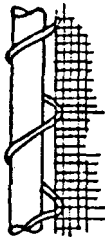
dowel so that the distance between the two dowels when the rope is stretched out is 200 cm.

(2) Mesh

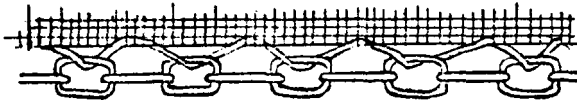


Use a mesh (F) from 0.25 to 0.50 cm square. Fasten it to the dowel (C), chain (D), and rope (A) as shown by using the small diameter nylon cord (E).

Attachment of Mesh (F) to Rope (A)



Attachment of Mesh (F) to Dowel (C)



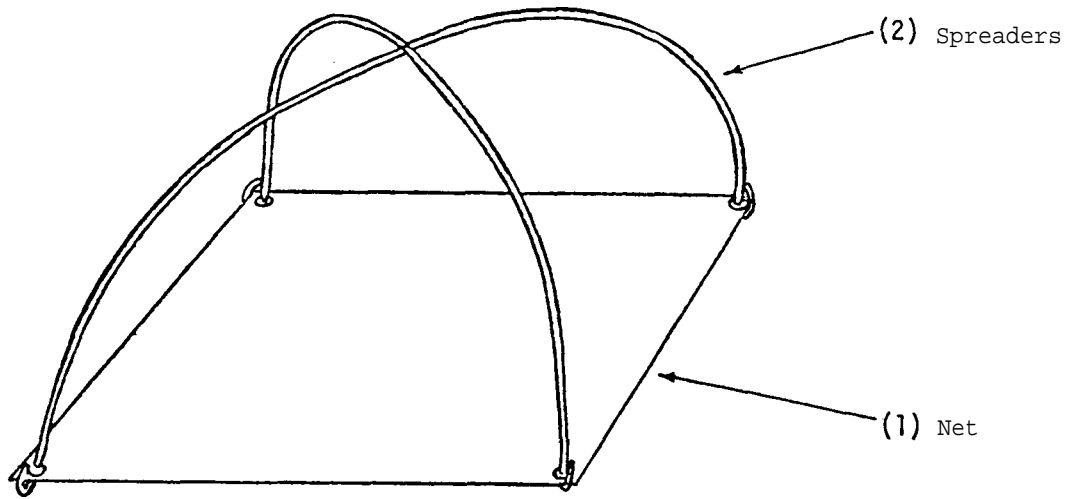
Attachment of Mesh (F) to Chain (D)

c. Notes

(i) Two persons are required to use the seine net. Each holds one of the poles upright in the water and they both walk slowly toward the shore. A great variety of organisms can be collected in this manner.

(ii) Wherever possible, use corrosion and rot resistant materials for the seine such as nylon rope, cord and mesh and galvanized chain.

A6. Lift Net *

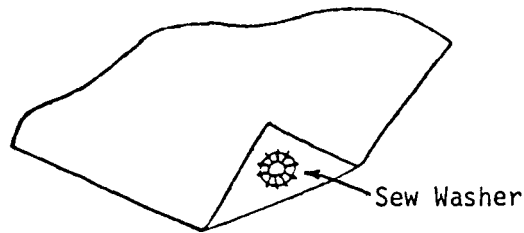


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Net	1	Nylon Mesh (A)	50 cm x 50 cm
	4	Metal Washers (B)	1.5 cm diameter
(2) Spreaders	2	Heavy Wires (C)	100 cm long, 0.3 cm diameter

b. Construction

(1) Net



Corner Detail

Construction of the lift net is quite simple. Simply fold over each corner of the nylon mesh (A) and sew a washer (B) to the double thickness of material. Punch a hole through the center of each washer and through the double layer of nylon.

*Adapted from Jens W. Knudsen, Biological Techniques, (New York: Harper and Row, 1966), p 283.

(2) Spreaders

Roll each wire (C) to a roughly semicircular shape. Insert one end of each wire through adjacent corners of the net and bend up the ends. Insert the other end of each wire through the corner diagonally opposite the first corner and bend up the ends again. Use a small piece of wire to bind the spreaders together where they cross.

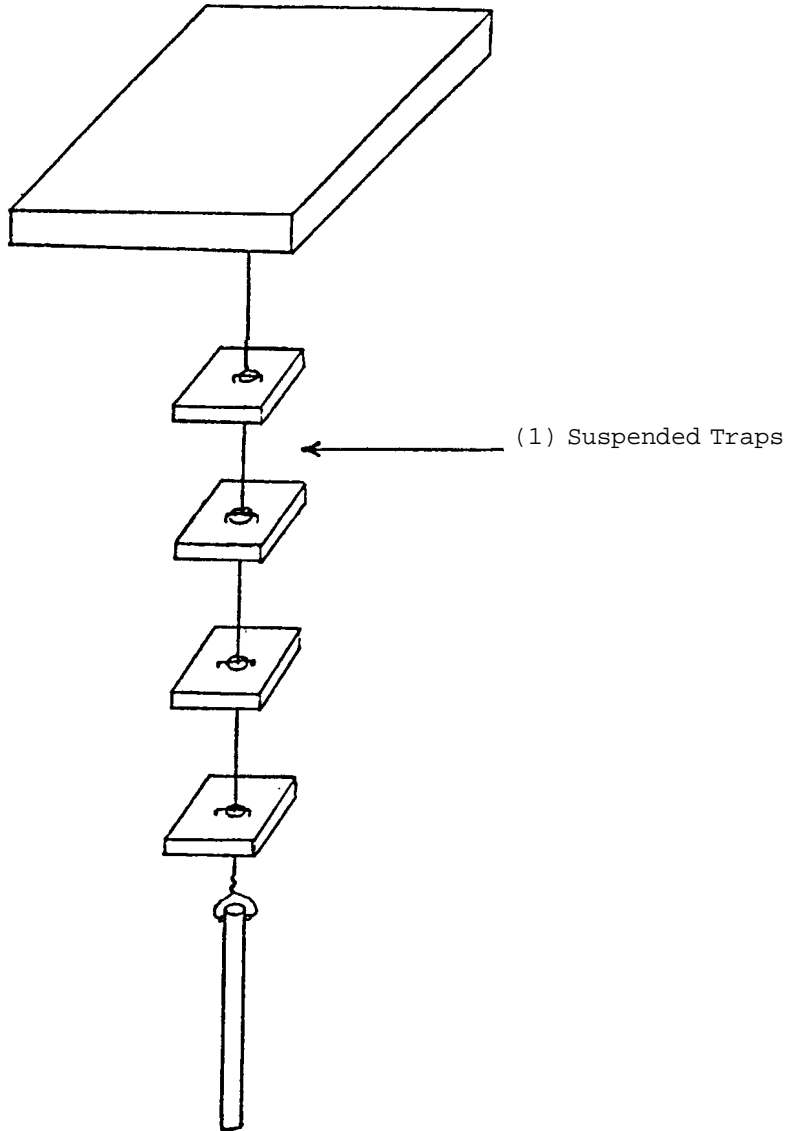
c. Notes

(i) Use the lift net to catch small fish and crustaceans. Place a suitable bait firmly tied to a weight in the center of the net. Tie a line to the lift net where the spreaders cross and lower the net into the water. If the water is clear, watch for fish or crustaceans to near the center of the net, and when they do, quickly lift the net to trap them. If the water is not clear, simply wait for one or two minute intervals before quickly raising the net.

(ii) Small fish may be collected by floating food on the surface of the water. As small fish come to the food, the net may be raised, and the fish collected.

B. AQUATIC TRAPS

B1. Piling Trap



a. Materials Required

Components

(1) Suspended Traps

Qu

Items Required

Wood (A)

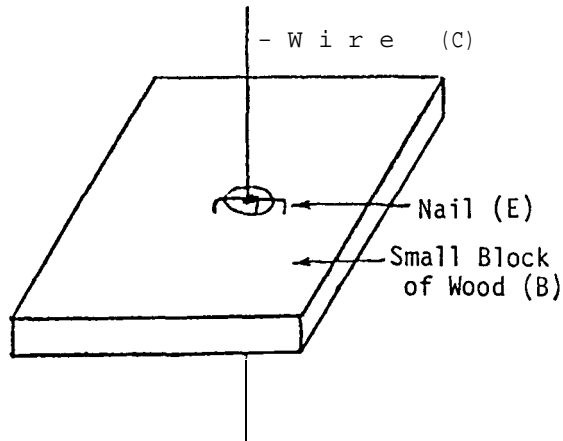
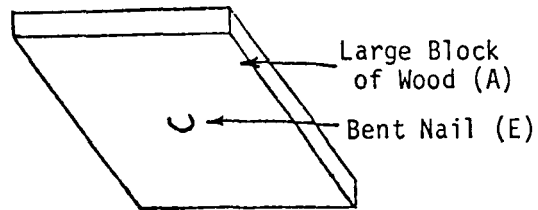
Dimensions

24 cm x 24 cm x 4 cm

4	Wood (B)	10 cm x 10 cm x 2 cm
1	Wire (C)	120 cm long, 0.1 cm diameter
1	Metal Rod (D)	26 cm long, 1.5 cm diameter
5	Nails (E)	2.5 cm long, 0.3 cm diameter

b. Construction

(1) Suspended Traps



Place a heavy staple or bent nail (E) in the center of the large block of wood (A). Drill a hole 0.4 cm in diameter through the center of each of the small blocks of wood (B). Place a nail (E) near each of the holes and wrap the wire (C) around these nails as it is passed through the holes. Bend the nails down across the holes. The small blocks should be spaced about 20 cm apart, with the first block about 30 cm from the large wood block (A), and the metal rod (D) about 30 cm from the last block. Drill a hole in the metal rod through which the wire is run, and connect the rod to the wire. Finally, attach the upper end of the wire to the staple or bent nail on the underside of the large block of wood.

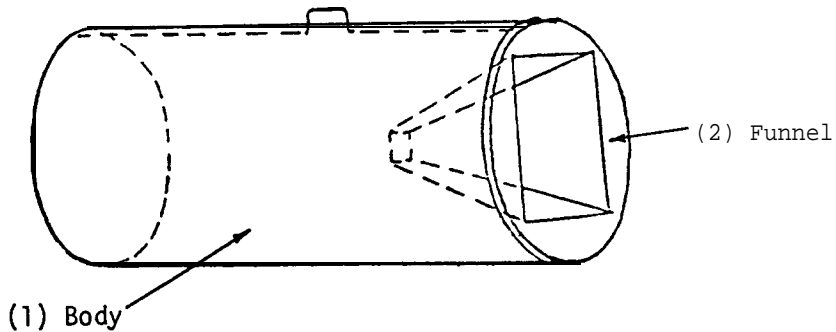
c. Notes

(i) Many aquatic animals attach themselves to the bottom of boats and piers. This trap utilizes this principle in capturing these organisms. To operate, simply place the apparatus in the water and remove approximately every 30 days and collect the organisms which have attached themselves to the blocks of wood.

(ii) The large wood block may be substituted for by some other type of float. A watertight plastic container (e.g., an empty plastic bottle of bleach) can be used. This float can be painted a bright color, thus making it easy to see.

(iii) Any type of weight may be used provided that it is not heavy enough to submerge the large block of wood while still keeping the small blocks of wood under water.

B2. Funnel Trap

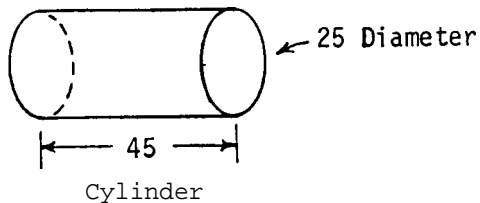


a. Materials Required

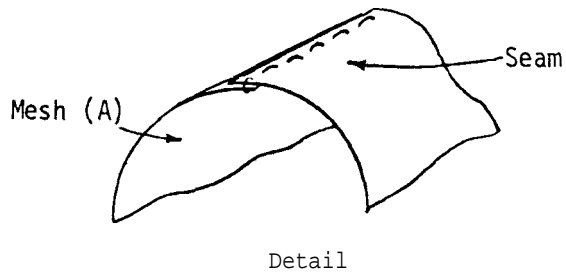
<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Body	1	Wire Mesh (A)	45 cm x 80 cm
	1	Wire Mesh (B)	25 cm diameter
	1	Stiff Wire (C)	85 cm long, 0.2 cm diameter
	1	Stiff Wire (D)	50 cm long, 0.2 cm diameter
	1	Fine Wire (E)	0.05 cm diameter, about 300 cm long
(2) Funnel	1	Stiff Wire (F)	85 cm long, 0.2 cm diameter
	1	Spring (G)	2 cm long
	1	Wire Mesh (H)	30 cm diameter
	4	Wire Mesh (I)	17 cm x 17 cm
	1	Fine Wire (J)	0.05 cm diameter, about 300 cm long

b. Construction

(1) Body

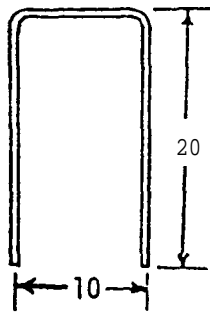


Make a cylinder 45 cm long and 25 cm in diameter from the rectangular piece of wire mesh (A). Wire the 45 cm sides together with the fine



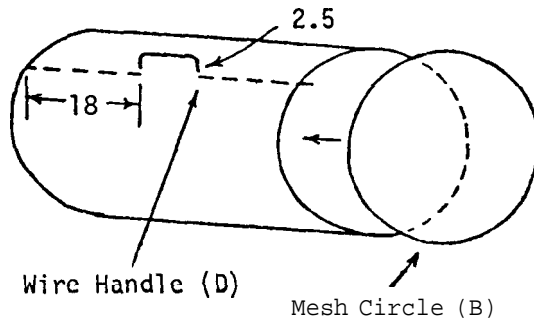
Detail

wire (E) in much the same way as one would sew a cloth seam. Let the edges of the mesh overlap about 1 cm to facilitate "sewing" them together with the wire.



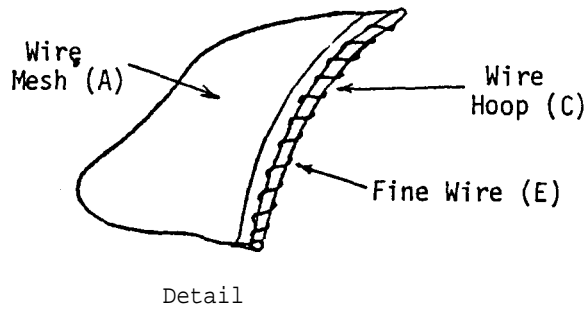
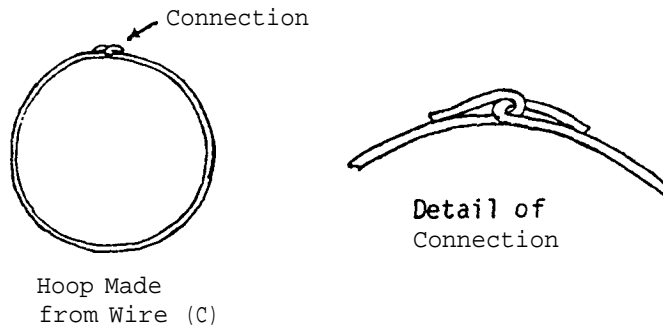
Wire (D)

Next, bend the stiff wire (D) to the shape of a "U". Make two small holes 10 cm apart in the cylinder. Insert the U-shaped wire through these two holes, and bend up the ends leaving about 2.5 cm of the wire extending out of the cylinder as a handle. Take the 25 cm diameter piece of wire mesh (B) and "sew" it to one end of the cylinder with a piece of fine wire (E) to seal it off.

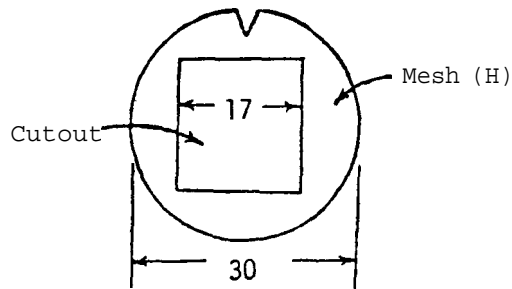


Wire Handle (D)

Mesh Circle (B)

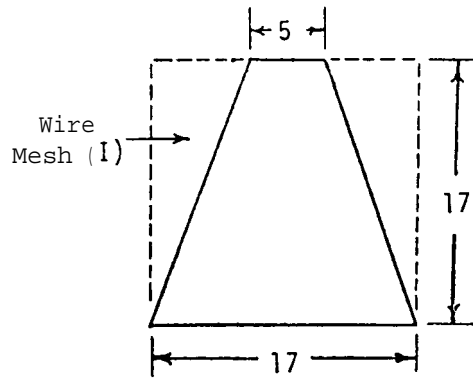


(2) Funnel

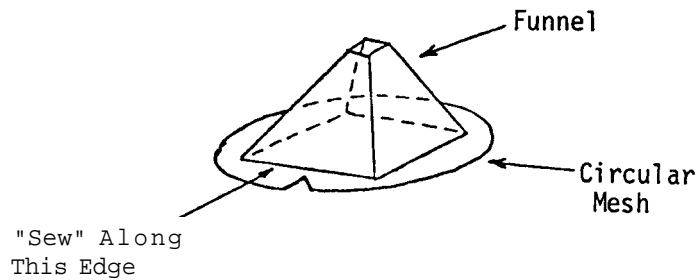
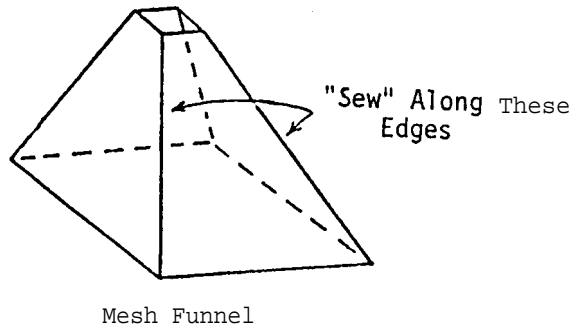


Finally, make a 25 cm diameter "hoop" from the stiff wire (C) by hooking the ends together. Connect the wire hoop to the open end of the cylinder with fine wire to stiffen the cylinder. This is best done by folding about 2 cm of the end of the cylinder back over the hoop and sewing the hoop inside this flap for the full circumference of the hoop.

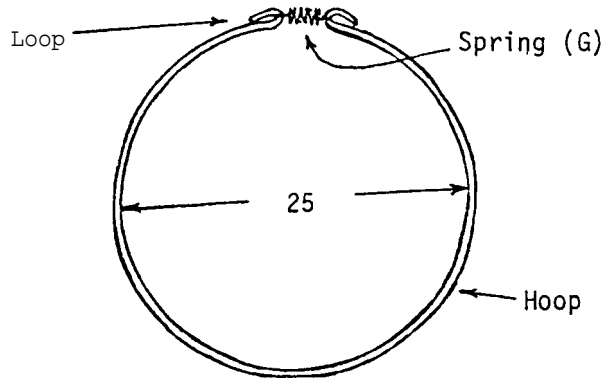
Cut a square 17 cm on a side from the center of the circular piece of wire mesh (H). Also, cut a V-shaped notch 2.5 cm deep in one edge of the piece of mesh.



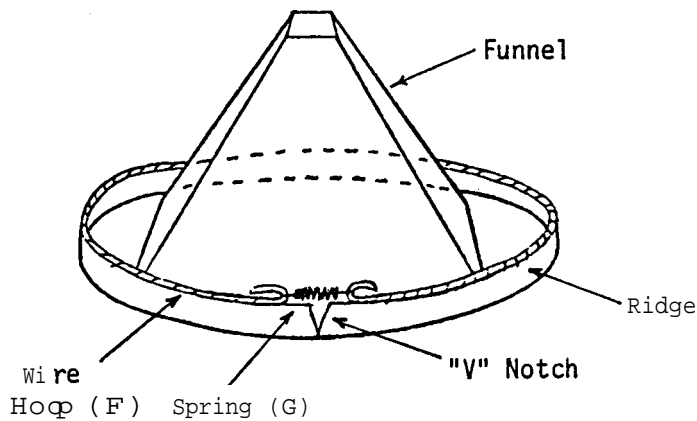
Cut the four pieces of wire mesh (I) into triangular-shaped pieces 17 cm at the base and 5 cm at the apex. Sew the four pieces together along their long edges with fine wire (J) to form a pyramid-shaped funnel.



Sew the funnel to the circular piece of mesh (H) with the square cutout.



Form a hoop from the stiff wire (F) 25 cm in diameter with small loops at both ends. Connect these two ends of the hoop with the spring (G). (Springs can easily be made by wrapping stiff wire around a pencil or other round object.)



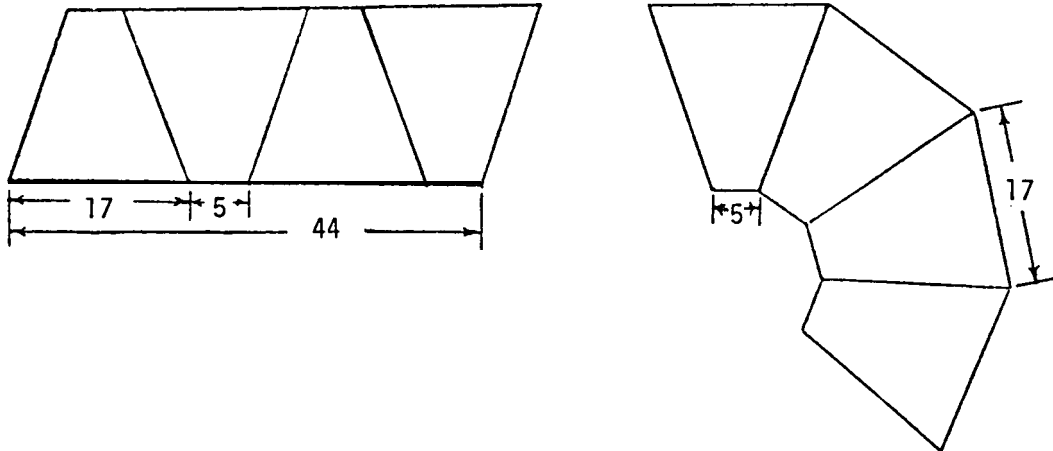
Now, fold up a ridge 2.5 cm high all around the circumference of the circular piece of mesh (H). Wire the hoop (F) to this ridge making certain the spring (G) on the hoop aligns with the "V" notch in the mesh. Fit this funnel assembly over the end of the cylindrical body by pulling the spring open slightly. Slip the funnel over the end of the cylinder and let the spring snap back. The tension of the spring should hold the funnel assembly to the cylinder relatively tightly.

c. Notes

(i) Use of the funnel trap is simple.. Just remove the funnel portion of the trap by spreading open the spring slightly and pulling the funnel off the cylinder. Place some rocks or other weights in the trap to hold it down in the water, and place a suitable bait (e.g., pieces of fish, old cheese wrapped in

a cloth bag) in the cylinder. Replace the funnel, and tie a length of rope to the handle. Drop the trap into a stream or pond, and tie the other end of the rope to an object on the bank or a float (a plastic bottle makes an excellent float). Check the trap periodically to remove captured animals and replace baits.

(ii) The following two patterns can also be used for the funnel:



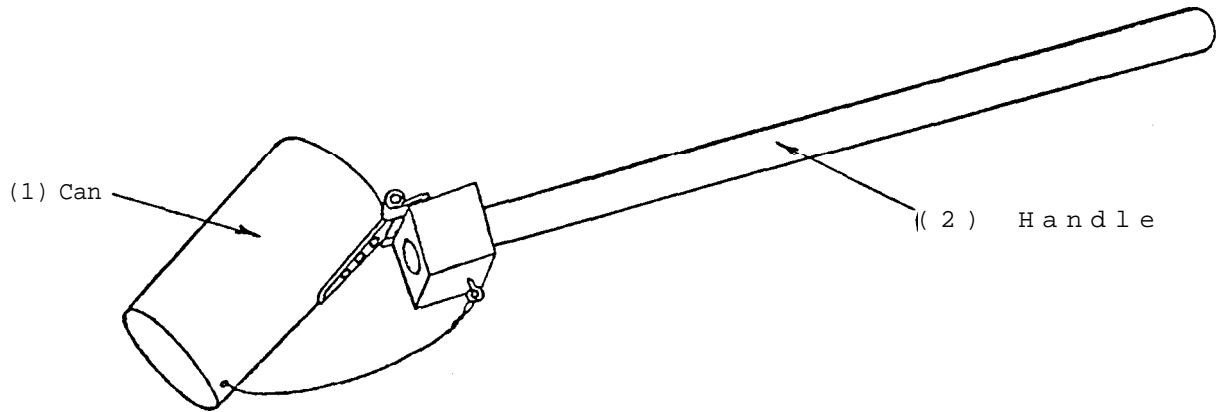
The first pattern is used because it wastes less material while the second is good because only one seam needs to be sewn while the others are merely folded.

(iii) Wherever possible, use rustproof materials like aluminum screening in the construction of this item.

(iv) The circular and other shapes can more easily be cut from the wire mesh if a pattern is first cut from paper and taped to the mesh. Then cut around the paper rather than attempting to draw a pattern on the mesh as this is extremely difficult to do.

C. SUPPLEMENTARY AQUATIC MATERIALS

Cl. Bottom Sampler

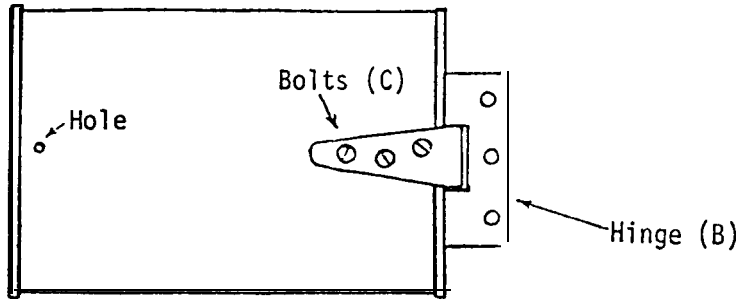


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Can	1	Tin Can (A)	12 cm long, 8 cm diameter
	1	Hinge (B)	--
	3	Bolts (C)	1.0 cm long
	2	Nuts (D)	To fit bolts
	3	Wood Screws (E)	1.0 cm long
	(2) Handle	1	Wood (F)
1		Wood Dowel (G)	2.5 cm diameter, length variable
1		Eyed Screw (H)	--
1		Wire (I)	18 cm long

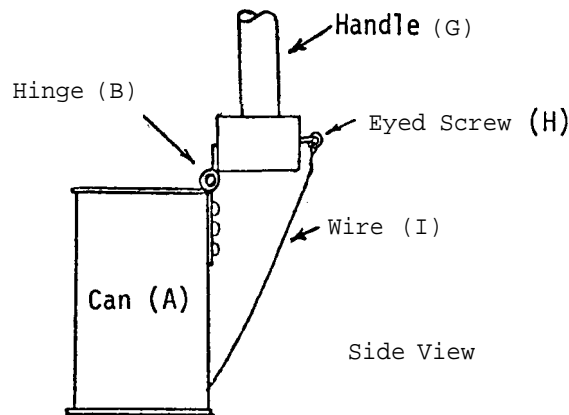
b. Construction

(1) Can



Top View

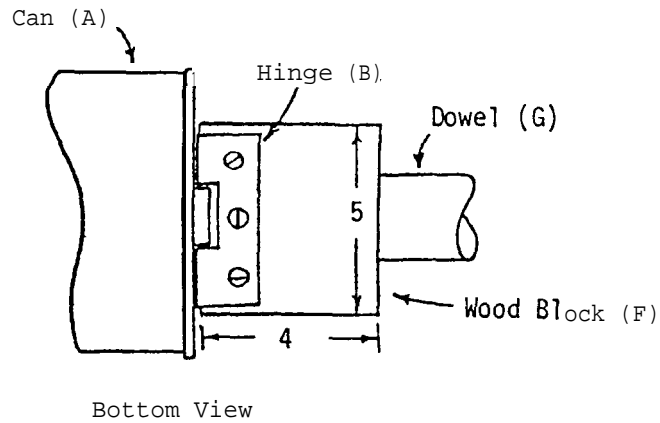
(2) Handle



Side View

Remove one end of the tin can (A). Punch a small hole near the bottom of the can. At the open end of the can fasten one plate of the hinge (B) to the can with the bolts (C) and nuts (D). Holes will have to be drilled or punched through the can for the bolts to go through. The hinge may be fastened to the can with sheet metal screws if these are available.

Drill or bore a hole the same diameter as the wood dowel (G) through the middle of the wood block (F). Insert one end of the dowel into the block and screw or glue them together. With screws (E), fasten the plate of the hinge (B) to the bottom of the block. Screw the eyed screw (H) into the other side of the wood block. Finally, make a knot in the end of the wire (I) and pass the free end through the hole in the bottom of the can (the knot must be inside the can) and tie the free end to the eyed screw.



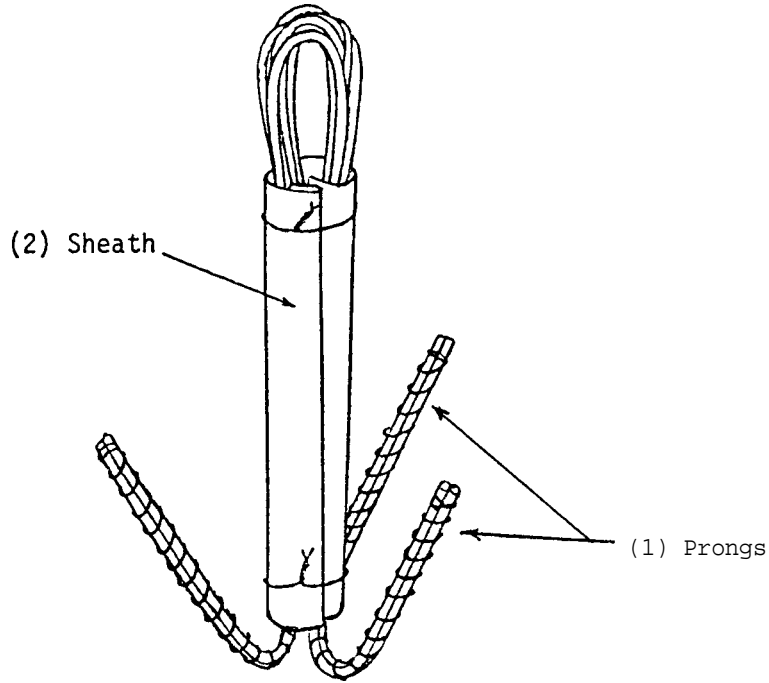
c. Notes

(i) To operate, simply lower the sampler into the water until the can hits bottom. Drag the can back and forth until it feels heavy, then pull it out of the water and remove the bottom sediment. The wire prevents the can from hitting bottom with the open end pushed against the handle so that no sediment can enter it. Collect bottom samples in different ponds and streams to check the sediment for the various organisms living in each.

(ii) The length of the handle will vary according to the depth of the water where the sample is to be taken.

(iii) The details of design of this item depend mainly on the type of hinge used.

C2. Grappling Hook

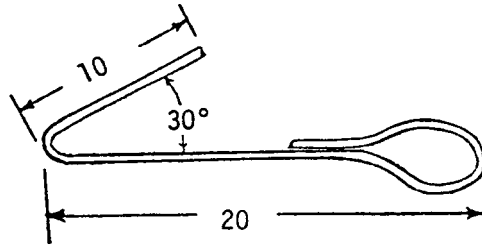


a. Materials Required

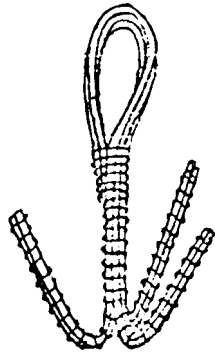
<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Prongs	6	Stiff Wire (A)	40 cm long, 0.25 cm diameter
	1	Soft Wire (B)	About 100 cm long, 0.05 cm diameter
(2) Sheath	1	Sheet Metal (C)	12 cm x 8 cm x 0.05 cm
	2	Soft Wire (D)	8 cm long, 0.1 cm diameter

b. Construction

(1) Prongs



Bend each piece of stiff wire (A) to the shape of a hook with a loop at one end. Group the prongs together by twos and bind them together



(2) Sheath

with the soft wire (B).

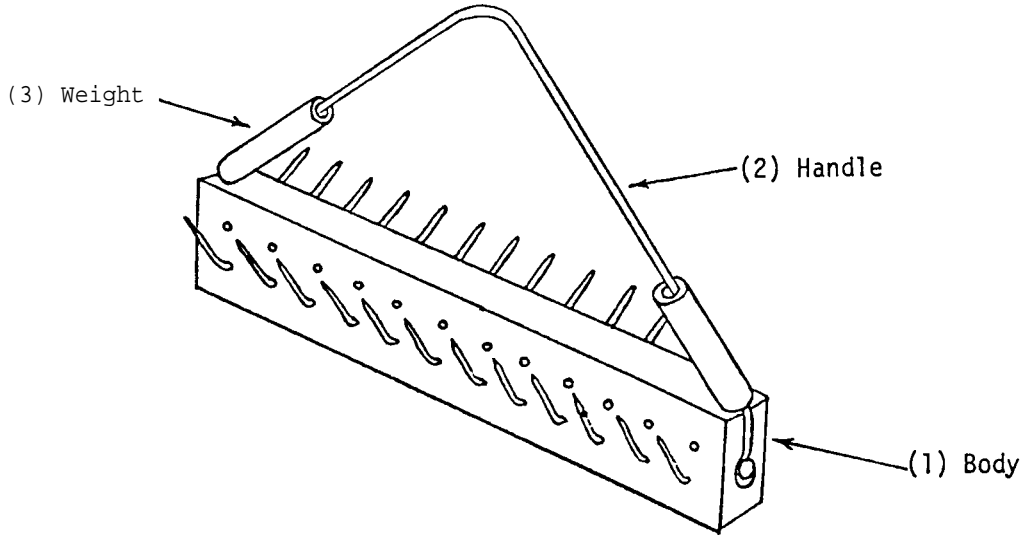
Then place the three resulting double prongs together and bind them so that the prongs are about at angles of 120° to each other.

To finish the grappling hook simply wrap the piece of metal sheet (C) around the middle of the hook and bind it in place with the soft wire (D).

c. Notes

- (i) To use the hook, just tie it to the end of a rope or cord, drop it into the water, and pull it up when it becomes entangled in vegetation.
- (ii) Be careful when handling this item of the sharp edges of the sheet metal and the points of the wire used in binding it together.
- (iii) If heavy steel wire is available, only one piece is needed per hook rather than two.

C3. Grappling Bar

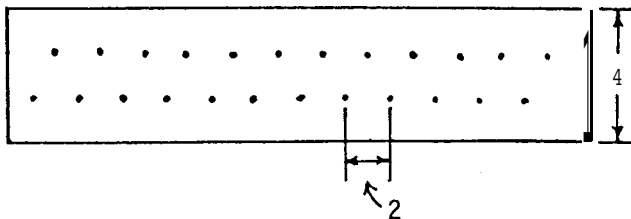


a. Materials Required

<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Body	1	Wood (A)	25 cm x 4 cm x 2 cm
	24	Nails (B)	5 cm long, 0.2 cm diameter
(2) Handle	1	Soft Wire (C)	50 cm long, 0.2 cm diameter
	2	Nails (D)	3 cm long
(3) Weight	2	Lead Pipe (E)	8 cm long, 1.5 cm diameter

b. Construction

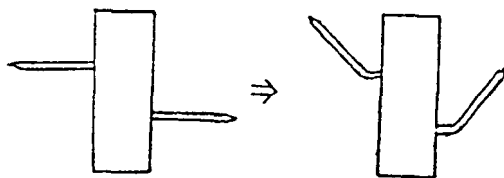
(1) Body



Drive the nails (B) through the wood (A) in two rows, staggering them so that they don't align directly above one another. One row of nails is nailed through from one side while the other row is

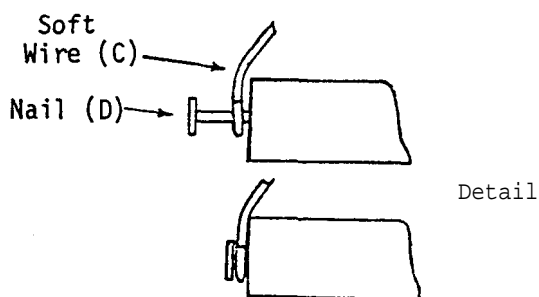
nailed through the opposite side.

Where the nails have been driven through the wood, bend them upwards at approximately 45° angles as close to the base as possible.



Side Views

(2) Handle



Hammer one of the nails (D) into the end of the body and let it protrude about 1 cm. Twist one end of the soft wire (C) around the nail, then hammer it down completely.

(3) Weight

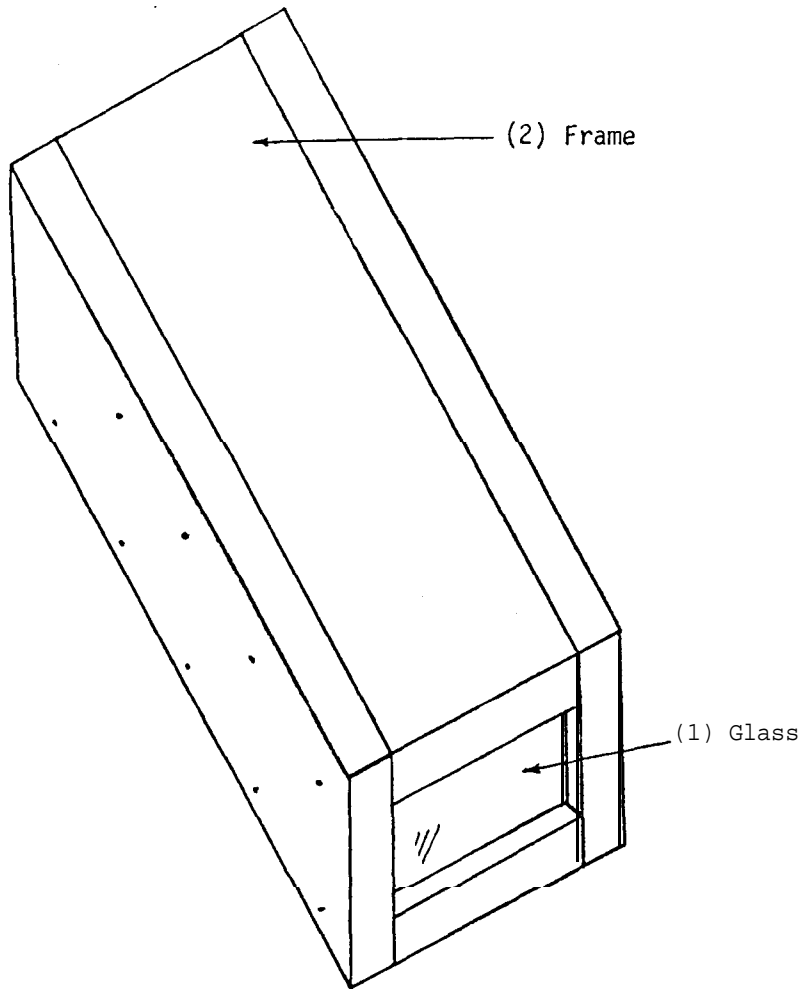
Slip the two pieces of lead pipe (E) over the free end of the handle, and fasten the free end to the opposite end of the body. Bend the handle at its middle allowing one weight to slide down each arm of the handle.

c. Notes

(i) To use the grappling bar, tie the end of a long, stout rope or cord to the handle. Drop the bar in water, allow it to reach bottom, and drag it along until resistance is felt, then haul it up. The bar works well for retrieving plant specimens from pond and river bottoms.

(ii) Be certain the weights are sufficient to sink the bar easily, as wood can be extremely buoyant.

C4. Water Glass



a. Materials Required

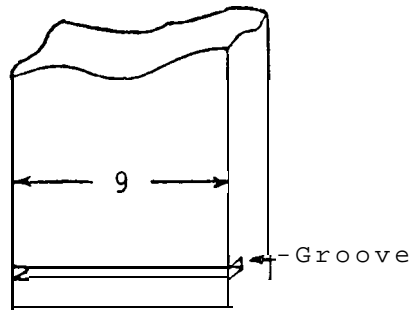
<u>Components</u>	<u>Qu</u>	<u>Items Required</u>	<u>Dimensions</u>
(1) Glass	1	Glass Plate (A)	6.3 cm x 10.3 cm x 0.3 cm
(2) Frame	4	Wood (B)	20 cm x 9 cm x 2 cm

b. Construction

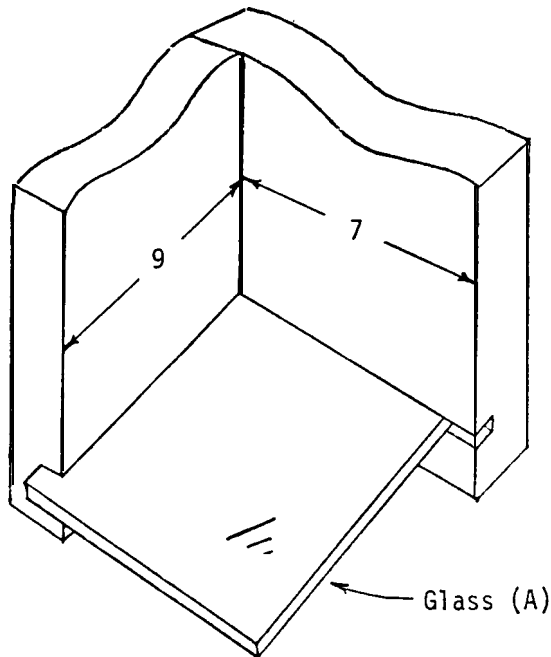
(1) Glass Plate

Cut the piece of glass (A) to the specified dimensions, making sure that all the edges are smooth and free of burrs.

(2) Frame



Cut a groove, 0.3 cm wide and 0.7 cm deep, across the width of each piece of wood (B), 1.2 cm from one end. Fasten two of the pieces of wood together at right angles using waterproof cement along the point of contact. Be sure that the grooves are lined up and that they face to the inside. Use nails or screws to reinforce this joint. Glue two sides of the glass plate into the two grooves, placing the long side of the glass plate into the groove in the piece of wood with a width of 9 cm. The next piece of wood should be placed so that the groove holds the larger of the two free sides remaining on the glass plate. The last piece of wood then fits over the final free end. These last two pieces of wood should be glued and nailed to the previously assembled structure



as they are put into place.
Seal the ends of the grooves
on the outside of the water
glass with waterproof cement.
Make certain all seams are
waterproof.

c. Notes

(i) The water glass is designed to view the bottom organisms of a body of water. When the end with the glass plate is inserted into the water, glare from the sun as well as surface ripples are eliminated.